



## CLINICAL REVIEW

# Medicolegal aspects of complex behaviours arising from the sleep period: A review and guide for the practising sleep physician



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## SUMMARY

This review is aimed at summarizing the current state of knowledge regarding parasomnias, which have been implicated in medicolegal cases as well as providing guidance to those working within common-law jurisdictions regarding the technical aspects of the law. Sleepwalking and sexsomnia as a defence are being raised more frequently in criminal cases and there has been public debate on their validity. Unfortunately, expert evidence on forensic sleep disorders continues to be heavily opinion-based with the potential for miscarriages of justice seen in recent highly publicized cases. There is an apparent inertia in research into violent sleep disorders. We review the current state of forensic sleep science in the United Kingdom (UK) and abroad and discuss the need to formulate guidelines based on available evidence. We also highlight the pressing necessity for more research in this area as well as the need to reform the law, which is the subject of a recent Criminal Law Commission report in the United Kingdom. In time, this will facilitate the efficient, proportionate, and just disposal of violence arising from sleep, thus benefitting both society and the individual sufferer.

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## Introduction

*"In all of us, even in good men, there is a lawless wild-beast nature, which peers out in sleep."* Plato *"The Republic"* Book IX, 571d

The implications of an incorrect diagnosis of either a non-rapid eye movement (non-REM) sleep disorder or rapid eye movement (REM) behaviour disorder to explain criminal behaviour are significant. On the one hand, the guilty or potentially dangerous may go free. On the other, an individual, whose only guilt lies in having an easily managed illness, may be incarcerated. There have been great advances in sleep medicine in the last decade – electroencephalography (EEG) monitoring of sleep, sophisticated imaging techniques and the recognition that psychiatric co-morbidities may influence sleep quality, sleep patterns and manifestations of parasomnias. However, whether a criminal act has occurred as a result of a parasomnia or arisen out of sleep is difficult to prove after the event – the circumstances can never be reliably reproduced.

There is an urgent need to critically re-examine legal perspectives on behaviours occurring during sleep which continue to be grounded in assumptions and decisions from the late 19th and early 20th centuries. These legal doctrines are increasingly out of step with our knowledge of the pathophysiology, treatment modalities and differential diagnosis of these disorders.

In this paper, we present a brief summary of legal definitions invoked in forensic acts performed during sleep or as a result of a sleep disorder. We focus particularly on the dearth of evidence to support both medical and legal decisions in this area. We aim not to review the forensic sleep cases in the literature, but rather raise points of discussion highlighting the problems with post-event testing and problems with proving a sleep defence.

Unfortunately, little original research is being done in this area [1]. Certain cases are reported over and over again in the literature and only a few centres in the world are undertaking limited studies in the field. Case reports tend to only expand the *possibilities* for forensic sleep behaviour, when what is arguably needed is systematic research to define the *probabilities*.

There is also a need for more research on the prevalence of criminal behaviour in sleep. It is usually preferable to have a parasomnia documented *a priori* than to seek to establish post-hoc evidence. This issue was identified by Mahowald and colleagues

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who reported an individual who experienced several incidents of violence allegedly in sleep, including chasing his wife and beating her with a hammer. Exhaustive investigations proved negative and it was felt he was trying to have his behaviour legitimated [2].

Psychiatric diagnoses that are often missed or not considered in the context of disorders of sleep (e.g., dissociation; fugue states) are also discussed and we emphasize an additional criterion for establishing the likelihood of a violent sleep disorder: physical proximity [3].

The first part of this review will focus on forensic sleep disorders, summarizing what is known and areas where evidence is lacking and the second part of this review will focus on the technical and legal aspects of violent parasomnias and behaviours arising out of sleep as examined under a common-law jurisdiction.

## Part 1: sleep disorders associated with violence

### Prevalence

The exact prevalence of sleep violence remains unknown. A telephone survey of the United Kingdom (UK) adult population suggested a prevalence of sleep violence of 2%. This assessment was based on administration of a standardized questionnaire (Sleep-EVAL system) rather than evaluation by a sleep specialist, and is likely to be an over-estimate as a result [4]. Sleep clinic studies have identified violent or harmful behaviour occurring in 59%–70% of patients with sleepwalking or sleep terrors; again, this is most likely an over-estimate due to the patient population presenting to specialized sleep clinics [5,6].

Most sleep violence is directed to the self. Given that trials involving putative sleep-related behaviour reported in the media are either homicide, sexual offences or motoring offences (bar one charge of criminal damage), this would suggest that other sleep-related violent offences may be dealt with informally. Research to quantify the amount of potentially criminal behaviour, which doesn't result in charges being brought, is required.

### Disorders of arousal

Disorders of arousal (AD) may arise from any stage of NREM sleep and are generally characterized by reduced vigilance, impaired cognition, retrograde amnesia and motor behaviours of variable complexity [7]. Although these can be associated with distressing non-narrative dreamlike mentations [8], they are not thought to be episodic or “acted out dreams” as occur during REM behaviours [9]. They are often precipitated by factors such as external sounds, respiratory events or movements in bed [10]. ADs occur in as many as 20% of children, and 4% of adults. Sleepwalking occurs for the first time in adulthood in 0.6% of adults [11,12]. Disorders that fall under this subheading include: sleepwalking; confusional arousals; and sleep terrors. Patients can experience more than one parasomnia per night but generally, they do not recur during a single night. Forensic behaviours have been described with all types of parasomnia as discussed by Pressman in 2007 [3] and summarized below:

#### Confusional arousals

Confusional arousals are characterized by mental confusion or confusional behaviour during an arousal or awakening from a nocturnal sleep or daytime nap, which is not better explained by other disorders or medication use [7]. Patients will often describe significant amnesia for these episodes.

Forensic behaviour that occurs during a confusional arousal usually displays all of these features, particularly impaired reasoning and memory for the event, incomplete awakening and

impaired vigilance, usually as a consequence of being woken from sleep [10]. Additionally, the victim was usually in close proximity at the time of the episode and confusional arousals are short-lived – usually lasting 30 s to a minute. However, the absence of one or more of these features does not exclude the diagnosis, and may simply reflect amnesia occurring around the event.

#### Sleep terrors (night terror)

During an episode of sleep terrors, the patient will experience a sudden episode of terror during sleep, usually initiated by a cry or scream. This episode is often accompanied by significant sympathetic nervous system activation and behaviour associated with intense fear. In addition, the patient will experience either difficulty in arousal, mental confusion on arousal, amnesia or potentially dangerous behaviours [7]. These occur as a result of incomplete awakening from non-REM sleep.

Often, sleep terrors are associated with vivid, frightening imagery and although this could be confused with a nightmare, sleep terror imagery is usually a single image that is less complex than the narrative sequence seen in a REM nightmare [13,14]. However, it is often difficult to distinguish between the two.

Unlike confusional arousals, case series of criminal acts occurring as a consequence of sleep terrors are not uniform [3]. Although all of the accused describe vivid, frightening images at the onset of the event, and all left the bed whilst displaying complex behaviours, two cases previously described as being associated with “sleep terrors” were either unprovoked or the victim was not near the attacker at the time of the onset of the behaviour [3] and are inconsistent with other cases within the literature. This casts doubt on the diagnosis.

#### Sleepwalking

Sleepwalking is defined as ambulation during sleep and is accompanied by difficulty in arousal, mental confusion on arousal, amnesia, routine behaviours occurring at inappropriate times, inappropriate or nonsensical behaviours, or dangerous behaviours, occurring without any other apparent cause [7]. Typically, a sleepwalker will engage in simple behaviours that reflect the impairment of higher cognitive function, and may engage in walking, running or simple searching behaviours. In at least five of the reported cases of forensic sleepwalking there was neither proximity nor provocation [3], again suggesting that the diagnosis may have been more complex or not entirely certain.

#### Sexsomnia

Although not classified as a unique parasomnia, atypical sexual behaviour in sleep (or “sexsomnia”) is mentioned in the International Classification of Sleep Disorders (version 2) (ICSD-2) as an atypical confusional arousal [7] and has been extensively documented from its first description in 1986 [15]. However, in addition to being a NREM phenomenon, atypical sexual behaviour during sleep has been described in association with REM parasomnias, nocturnal seizures, restless legs and narcolepsy [16].

These behaviours can take a variety of forms, including masturbation, direct sexual intercourse with a partner, fondling or sexual sleep talking. Other forms of sexual behaviour can arise as a consequence of seizures during sleep, including hyperkinetic sexual movements or automatisms, ictal orgasm and hyperarousals.

These behaviours will have forensic implications particularly when occurring with someone other than the usual bed partner. The spectrum of behaviour is broad, including rape, sexual abuse of minors and inappropriate exposure. In a recent review of sexsomnia, 45% of patients had assaultive behaviour, 29% engaged in paedophilia and 36% were convicted as a consequence of their sleep behaviour [16]. These results are in contrast to a commonly quoted

internet-based sleep sex survey of 219 subjects of whom 31% were females and 69% were males. The majority of the respondents (~80%) reported multiple sexsomnia episodes and heterosexuality [17].

As with sleepwalking, many of the cases highlighted above occurred without proximity or provocation and are included as complex “sleepwalking”.

#### *Complex “sleepwalking”*

Several cases described in Pressman’s review and highlighted earlier did not show either provocation or proximity and were usually attributed to either sleep terror, sleepwalking or sexsomnia [3]; however, on review of these cases, these behaviours involved cognitive domains and executive function that would not be in keeping with the simple “mental state” one would expect in an AD. Further, where the only historian is the putative sleep walker, these accounts are often unreliable. In this setting, a sleep-related dissociative disorder may have been a more a credible, alternate diagnosis (see below).

#### *REM behaviour disorder*

Although ADs can result in potentially harmful behaviour, equally complex and dangerous behaviours can occur during REM sleep although these cases are very rare. REM-behaviour disorder (RBD) results from REM sleep without atonia, confirmed on electromyography (EMG), with abnormal behaviours that are either injurious or disruptive, or movements that are captured on video; no EEG changes suggestive of epilepsy, and no other precipitant such as severe sleep apnoea [7].

RBD is thought to represent “acting out” dream mentation. The individual, whose eyes are usually closed, (in contrast to AD where the eyes are usually reported as being open) appears to interact with their dream rather than their immediate environment, and the behaviours are usually restricted to the bedroom. The behaviours are often brief and, if awoken, the individual is orientated with a recollection of a dream that corresponds to the behaviour [18]. Although RBD can be aggressive or violent, this does not appear to correlate with the waking personality [19].

The prevalence of RBD has been estimated at 0.5% of the UK population [4,20] and predominantly affects men with the majority of patients presenting between 52 and 61 years of age [21], although this is likely to be a significant underestimate as RBD appears to be under-diagnosed [20,22] with a long diagnostic delay [23].

Importantly, RBD can be the precursor by up to several decades of an alpha-synucleinopathy such as Parkinson’s disease or dementia with Lewy bodies, and can also occur in dementia of other cause, most commonly Alzheimer’s disease. Violence during sleep in dementia, therefore, may result directly from the presence of RBD and this should be borne in mind when assessing the patient presenting with such a history.

#### *Dissociation and sleep*

Dissociation is an important differential diagnosis for ‘complex sleepwalking’, which can also exist as a co-morbidity in the same individual (Rumbold J, Morrison I, Riha RL; in review 2013).

During dissociation, the patient enters an altered state of consciousness, during which disruption of awareness, memory and identity arise as a result of separation of otherwise integrated cognitive and psychological functions [24,25].

The ICD-2 recognizes sleep-related dissociative disorder as the nocturnal variant of daytime dissociative disorders [7]. Criteria for its diagnosis include a dissociative disorder based on Diagnostic and statistical manual of mental health disorders-IV-text revisions (DSM-IV-TR) criteria [26] with dissociative episodes

arising during the main sleep period. In addition, dissociative episodes occur when the person is awake either during the transition from wake to sleep or from sleep at night.

If we consider nocturnal dissociative behaviours as being related to DSM-IV-TR and ICD-2 criteria, the number of patients diagnosed with this disorder and reported in the literature is sparse. The only published case series on this disorder by Schenck et al. [27] has suggested that the preponderance of patients are female, have a history of sexual abuse and post-traumatic stress disorder (PTSD) and have additional dissociative episodes during the daytime. These features are almost never present in the history of “simple” sleepwalking. Subjects exhibited a variety of behaviours during these episodes, several of which were potentially harmful, and were accompanied by amnesia.

One study looking at 150 patients with sleep-related injury diagnosed 5.3% of the sample with sleep-related dissociative disorder ( $n = 8$ ) [27]. These episodes began after sleep onset and participants had amnesia for the episodes, appearing on history to be very similar to other arousal disorders. Subsequently, this cohort of patients was later diagnosed either with multiple personality disorder or dissociative disorder. Increasingly, it is clear that nocturnal dissociative disorder is an area of sleep medicine that is poorly characterized with limited information available to guide the sleep physician.

As an analogy, patients who experience functional epilepsy (pseudoseizures – a form of dissociation) and have undergone functional magnetic resonance imaging (MRI) [28] show stronger connectivity between emotion (insula), executive control (inferior frontal gyrus and parietal cortex) and movement (precentral sulcus) than normal matched controls.

A single case of a patient with a very complex dissociative disorder undergoing positron emission tomography (PET) scanning showed bilateral, temporal frontal lobes and right caudate lighting up in association with the manifest behaviour [29] and a single patient with fugue state displayed waking EEG rhythm at the point in time when the patient stated that they had been asleep and experienced their fugue behaviour [30].

By contrast, the single arousal disorder documented with intracerebral EEG monitoring [31] showed a pattern of wakefulness in the motor and cingulate gyrus arising out of Stage 2 Non-REM sleep (N2) with simultaneous intermittent bursts of delta sleep (slow wave sleep (SWS)) in the fronto-parietal lobes. This is considered to explain the lack of awareness and insight typically observed during simple arousal disorders.

An alpha EEG rhythm occurring shortly on arousal from NREM sleep is not considered diagnostic of dissociative disorder, since disorders of arousal may also have an alpha rhythm. An arbitrary lag-time definition is then invoked and the statement is made: ‘With disorders of arousal, the behaviours emerge almost immediately after the EEG arousal. With sleep-related dissociative disorders, there is often a lag-time of 15–60 s between EEG arousal and behavioural activation [7].

Clearly, there is very little information available to enable either confident diagnosis or management based in objective testing and very little evidence that has been replicated to support the above assertions.

#### *Factitious disorders*

Even less consideration has been given towards factitious disorders, which may present in a similar fashion to nocturnal dissociative disorders and disorders of arousal.

Factitious disorders (Munchausen syndrome) are diagnosed when the patient deliberately produces or falsifies a presentation of an illness with the purpose of either assuming the sick role or causing a sick role in another person (by proxy). There are very few

cases documented in the literature regarding parasomnias [32,33], although there are more regarding other disorders such as narcolepsy [34,35]. This may be because cases are difficult to diagnose on historical grounds, the clinician did not consider the possibility or EEG recordings were not made to confirm a neurological basis for episodes. Malingering has also been observed but there are no known case studies or case series in the literature regarding this disorder in relation to parasomnias. There is an obvious incentive for defendants to mangle where an episode of parasomnia will afford them the defence of automatism.

However, the literature gives greater guidance with respect to factitious disorders, particularly in the area of neurology and psychiatry. Generally speaking, young females with secondary gain are more likely to present to clinics with factitious disorders, often with a medical or related background (e.g., nurse or sibling with the condition being simulated). Psychiatric disorders affecting daytime mood may also play a role, in particular, depression [36].

#### *Predisposing factors to violent parasomnias*

There is no clear single factor that predisposes an individual to abnormal sleep behaviour or sleep-related violent behaviour. However, most patients have an underlying predisposition or diathesis that, combined with one or more precipitant factors, causes an episode on a particular night [5]. Predisposing factors include gender, genetic inheritance, psychophysiological dysfunction, personality type and structural brain abnormalities.

Although the triggers for violent behaviours are unknown, sleepwalking and sleep terrors are more likely during periods of increased sleep pressure and fragmented sleep. Causes of these include sleep deprivation, use of medication for mood disorders or insomnia (e.g., zolpidem) and circadian timing problems. Causes of fragmented sleep include stress, sleep-disordered breathing, environmental factors and endogenous stimuli [37,38].

#### *Gender*

The most consistent risk factor for sleep-related violence appears to be male gender, with violent behaviour in AD being 1.6–2.8 times more common in males [5,39,40], with an even higher proportion (97% of injuries and 80% of lethal behaviours) in RBD in males [18,39].

However, these figures may be an over-estimate. Violent behaviour is generally more common in males [41], but a confounding factor is that older females are less likely to have a bed partner and so they will be less likely to inflict violent or injurious behaviour. Likewise, social stigma may prevent men from reporting violence from their female bed partner [23].

#### *Genetic factors*

Strong familial patterns have been identified in certain families who have idiopathic confusional arousals, but these associations have not been characterized in more detailed studies [42], so these findings must be treated with caution. Some studies have suggested that sleep walkers are ten times more likely to have an affected first degree relative than the general population, with either two-threshold multifactorial inheritance or recessive inheritance with incomplete penetrance being proposed [43]. Similar findings have been shown in children and twin studies [44,45].

The evidence for genetic causes of other parasomnias is less robust although there is a suggestion of a genetic association with sleep terrors in possibly either an autosomal dominant or two-threshold multifactorial mode of inheritance [46–48]. Trends have also been seen in twin studies [44,49].

Specifically, it has been shown that violent behaviour was more frequent in family members of patients who had committed sleep

violence, with at least 10% reporting at least one other family member (most often the father) who had violent behaviour, compared to 1.2% of control populations, albeit within the methodological concerns subsequently expressed about the study [5]. Despite this, sleep terrors and sleepwalking have also been shown to be more common in the families of patients with sleep violence [50].

Whether this represents a true genetic component or is resultant from behavioural role modelling or environmental factors is unknown.

The genetics of RBD are even less understood. However, the association of RBD and narcolepsy has led workers to suggest an association with human leukocyte antigen (HLA) class II genes [51–53]. The mechanism of these genetic predispositions and how they affect brain function is not known.

#### *Physiological factors*

One of the original studies on sleepwalking violence identified that most arousals occur within 30 min to two hours of sleep onset, and most adults who exhibit this behaviour have had arousal disorders (mainly sleepwalking) as children [39,54]. This suggests an underlying physiological tendency to abnormal behaviours.

Sleep-disordered breathing is a recognized trigger for abnormal behaviour during sleep. One case report also described a violent confusional arousal triggered by successful treatment of sleep-disordered breathing [55]. Periodic limb movements of sleep can also precipitate sleepwalking episodes, most likely by increasing the frequency of arousals [56].

The frontal and limbic systems in the brain have been implicated in the pathogenesis of violent parasomnias and these systems are strongly associated with the genesis of violent behaviour [57]. Underactivity or reduced size of these areas has been significantly correlated with violence during wakefulness [57,58]. Frontal lobe deactivation is seen in slow wave sleep and sleep deprivation [59,60]. The single study of a sleepwalking patient in the literature has shown that, during sleepwalking, regional blood flow to the posterior cingulate cortex and anterior cerebellum increased by 25% while blood flow to the frontal lobes was reduced [61]. It is premature to draw conclusions from a study of one patient, but the reduced blood flow to the frontal lobes during slow wave sleep or as a consequence of sleep deprivation may explain why sleepwalkers tend to respond in a violent fashion in this state.

Evidence to support these hypotheses is weak and only supported by case reports, case series and expert opinion. Longitudinal studies of precipitants of ADs are absent from the literature.

#### *The role of psychopathology*

There are limited studies examining whether patients with ADs exhibit abnormal processing of emotion during the daytime, and very few that have dealt with RBD [62].

Whether or not ADs have a psychological or psychiatric basis remains controversial. Anxious, depressive, obsessive–compulsive and phobic traits as well as difficulty handling aggression, major life events and mental stress have been associated with sleep walking and night terrors, particularly in adults [63]. The incidence of mood disturbances appears to be higher in patients with ADs than in the general population, but a lack of case-control studies or longitudinal studies makes it difficult to establish whether this is causative or simply due to recruitment bias [63].

A study by Modolfsky [5] showed that men with sleep walking and sleep terrors manifested violent behaviour towards other people in association with stress, a disturbed sleep–wake schedule, excessive use of caffeinated beverages, drug abuse and SWS deprivation. The study was retrospective, thus prone to recall bias and also considered a very preliminary investigation by the authors that requires further studies to confirm the findings.



However, violent behaviours from sleep are usually isolated events and not recurrent, therefore an underlying psychological factor may only be one part of a combination of circumstances that precipitate the event.

#### *Dream content*

Although ADs are not thought to be associated with abnormal daytime emotional processing, there is a suggested association with emotion during arousals from sleep that may act as a trigger for behaviours.

Dream-like mentations can occur during sleep walking and sleep terrors in adults that are very simple and do not require significant executive functioning of the frontal cortex. A study by Oudiette et al. [8] demonstrated that patients with ADs had dream-like mentations consisting of a single visual scene with the vast majority of these being unpleasant, involving aggression, misfortune and anxiety, although some of these recollections were based on memories of events from years before. Almost all cases included a strong emotional component [64].

Thus, behaviours occurring in this state may be hostile due to the negative emotional associations described during or triggering these mentations and the documented inhibition of fronto-parietal activation [61,31].

However, it should also be noted that amnesia is also often associated with ADs and friends or families, rather than the actual dream mentation itself, may influence recollection of memories. The emotional content of ADs and their relationship to behaviours clearly requires further investigation.

#### *Environmental and behavioural factors*

ADs can be exacerbated by a variety of factors such as alcohol, sleep fragmentation, co-occurrence with other sleep disorders (namely sleep apnoea) [10]. In particular, the role of proximity is extremely important and relevant. Pressman examined the role of physical contact and proximity triggering sleep-related violence and showed that 100% of confusional arousals, 81% of sleep terrors and 40–90% of sleep walking cases were associated with provocations including noise, touch and/or close proximity [10].

#### *Alcohol controversy*

The role of alcohol is controversial. At the moment, there are certainly good grounds for skepticism when an individual who is heavily intoxicated claims to have been sleepwalking. The “Principles and Practice of Sleep Medicine”, for example, explicitly states that alcohol is not a trigger for parasomnias [65], based on a dearth of evidence to support alcohol as a defence [66,67]. Although this opinion is not held by all forensic sleep specialists [68], the debate lies beyond the scope of this review.

#### *Diagnosis of parasomnias associated with violence*

##### *History*

The diagnosis of ADs is usually made from clinical history [69]. Typical features include:

- 1) The person is difficult to rouse
- 2) Mental confusion occurs as a result of being awakened from an episode of sleep walking or other arousal disorder
- 3) Complete or partial amnesia for the episode occurs in the morning
- 4) Dangerous or potentially dangerous behaviours can occur during the episode.

However, much of the diagnostic criteria quoted above are dependent on eye-witness history that may not be present or

reliable. The act should be impulsive, senseless and without apparent motivation, with the interaction initiated unintentionally or by the victim. Many diagnoses of sleep disorders in defendants are not formally or medically documented prior to the criminal episode [70]. The fact that the defendant didn't seek medical attention prior to the episode has no probative value, as we know that patients with sleep disorders can delay seeking help for many years [23].

#### *Investigations*

Neither RBD, nor ADs may manifest during a single overnight polysomnographic (PSG) study in the sleep laboratory. When they are present, they may not be related to the original episode associated with violence. In recent times, sleep walking has been associated with subtle changes on PSG, leading authors to suggest these could be used as diagnostic markers for sleep walking [71]:

- 1) Increased arousals from slow wave sleep
- 2) Presence of hypersynchronous delta waves (HSDW)
- 3) An increase in the cyclic alternating pattern (CAP)
- 4) Delta frequency activity across the entire sleep period.

However, none of these methods have been trialled in a longitudinal setting, nor reproduced consistently in subsequent studies. Thus, the current consensus remains that sleep studies alone have nothing to add in terms of evidence for the diagnosis of sleep disorders associated with complex behaviours leading to violence [56,72,73]. The diagnosis of RBD utilizing PSG is likewise not straightforward with very recent studies attempting to define EMG criteria during REM to diagnose loss of atonia [53,74].

#### *Precipitating behaviours*

The known precipitants of ADs have been used by some clinicians to provoke an episode of a sleep disorder, in an attempt to provide “objective” evidence that the patient could and did commit the act during a sleep-related episode. These include arousing the defendant during slow wave sleep, sleep depriving the defendant and using alcohol prior to bedtime to trigger an episode. However, there is no evidence for the effectiveness and validity of these approaches. Sequential PSGs are likewise not recommended as standard investigative procedures.

Additionally, there is no literature discussing the use of urine drug screens (for drugs of abuse) or hair samples and blood tests at time of occurrence of the sleep violence, though some of these tests might be undertaken by the investigating authorities immediately after the event.

## **Part 2: medico-legal aspects of sleep violence**

In this section we focus on the technical and legal aspects of sleep-related violence as referred to above and discuss through example cases where guilt has either been attributed or the defendant exonerated. We commence with the definition of two concepts vital to the understanding of this area of the law, namely ‘automatism’ and ‘insanity’, before discussing the classifications of sleep disorders under the law and the special case of sleepwalking.

Table 1 details the features of an episode which will tend to support or refute a parasomnia defence. Many of these are issues of fact which are for the jury to decide, although the expert witness may indicate his/her assessment. For example in Lowe, attempts to mop up blood were argued by the prosecution to be an attempt to cover up, but by the defence to be simply cleaning up. There are further features that are specific to a specific parasomnia diagnosis e.g., in REM sleep behaviour disorder the eyes will be shut.

**Table 1**

Features that support or refute a parasomnia defence.

Strongly supports defence	Supports defence	Neutral	Refutes defence	Strongly refutes defence
Reliable eye witness account absolutely consistent with parasomniac behaviour		"Accused didn't appear to be asleep"		Reliable eye witness account totally inconsistent with parasomniac behaviour
Unable to identify close relatives and friends		Mumbled conversations		
	Confused behaviour	Complex learned behaviour such as driving		Evidence of planning
	Difficulty navigating obstacles	Navigating familiar environments	Navigating unfamiliar environments	Evidence of working memory or higher cortical function
	Sexual activity with bed partner			Seeks out partner for sexual activity
	Reaction to confrontation, victim nearby			Seeks out victim
	No motive or advantage from event		Clear motive	
	Activity contrary to waking sexual orientation, no evidence of sexual arousal (sexual offences)		Sexual attraction	
	Shock and horror at actions, inconsolable.	Denial.		
Previously diagnosed parasomnia behaviour in keeping with episode	Personal and family history of parasomnias and/or sleep disorders, especially when verified by several parties	Parasomnia or sleep disorder was diagnosed retrospectively		No previous history of parasomnia
	Out of character		Consistent with character	
		Total amnesia or very fragmented memories		Clear memory for events
	Roused with difficulty and confused on arousal		No change in state when confronted and responds appropriately to situation	
	Immediately identifies behaviour as parasomnia			Attempts to cover up illegal act (see above)
		Lack of specific findings on video-PSG		

PSG, polysomnography.

*Automatism (insane and non-insane)*

Criminal liability usually requires that two elements must be present: *actus reus* (literally "guilty act"), and *mens rea* (literally "guilty mind"). The Latin maxim "*Actus non facit reum nisi mens sit rea*" states that "the act does not make a person guilty unless the mind is also guilty" [75]. The *actus reus* is the prohibited conduct, performed voluntarily.

The required *mens rea* may be intent, recklessness, negligence or knowledge (no *mens rea* is required in the case of strict liability crimes – most motoring offences, for example). This means that the defendant's state of mind is relevant to many offences, and in states like parasomnia where there is no "state of mind", he cannot be convicted of an offence where a specific *mens rea* is required (with the possible exception of negligence)

This distinction between *actus reus* and *mens rea* is grounded in cartesian dualism i.e., that the mind and body are separate. Our current understanding of the human brain is much more sophisticated, and the legal concept of automatism therefore becomes problematic. We now understand that motor functions are separate from the higher cognitive functions required to be present for full criminal responsibility.

Automatism is where a person with grossly impaired consciousness or in a state of unconsciousness can perform acts that are not the product of any effort of conscious will, acting as an "automaton" [76]. Someone in a state of legal automatism is not acting voluntarily and so cannot have carried out the *actus reus* (nor could they have the required *mens rea*). If the accused lacks the

requisite *actus reus* or *mens rea*, then the offence is not made out. The denial of *actus reus* means that automatism is one of the few defences to a strict liability crime (which explains why it is raised more often in motoring offences). Several publications on forensic sleep mistakenly state that automatism is a denial of *mens rea* [77,78] – Siclari et al. state that:

"In alleged violent behaviour during sleep, *actus reus* is usually never in doubt, whereas the medical expert will need to provide compelling arguments related to *mens rea*, or the claimant's degree of consciousness." [78]

This is incorrect as the authors are confusing the *actus reus* and the illegal act. Bird, Newson and Demnby correctly describe the defence of automatism as it is used in legal practice when they state:

"Automatism is a complete defence to any criminal charge if it goes to the *actus reus* (guilty act), as well as to nearly all crimes (other than strict liability crimes) if it goes to the *mens rea* (guilty mind)." [79]

They are incorrect in the purist doctrinal sense, as the denial of *mens rea* is unconsciousness, rather than involuntariness – however the two concepts are often conflated in the courts [80].

Where the crime is not strict liability, the defence only has to prove unconsciousness, which is the denial of the *mens rea*. It is easier to prove that the defendant lacked the requisite state of mind due to unconsciousness than to prove they had a total loss of control (involuntariness). For example, if the case is homicide, the defence only has to prove that the accused didn't intend to kill or

seriously harm the victim. They do not have to prove that he had a total loss of voluntary control.

This describes automatism *simpliciter*, known in common law jurisdictions as non-insane automatism. Non-insane automatism has an external cause. For the defence of non-insane automatism, the defence first has to provide sufficient evidence for the defence to be put to the jury (an evidentiary burden). Thereafter the burden of proof is on the prosecution to prove beyond reasonable doubt that the defendant did not suffer a total loss of voluntary control. Insane automatism is simply the defence of insanity (see below). Any internal cause of automatism is insane automatism, and this includes sleep walking (Burgess). In England and Wales, the insanity defence puts the burden of proof on the defence, who has to prove on the balance of probabilities that the defendant fits the criteria of the *MacNaughtan Rules*.

The MacNaughtan Rules (often spelled M'Naghten Rules) state that *"the jurors ought to be told in all cases that every man is to be presumed to be sane, and to possess a sufficient degree of reason to be responsible for his crimes, until the contrary be proved to their satisfaction; and that to establish a defence on the ground of insanity, it must be clearly proved that, at the time of the committing of the act, the party accused was labouring under such a defect of reason, from disease of the mind, as not to know the nature and quality of the act he was doing; or, if he did know it, that he did not know he was doing what was wrong."*

In summary, in insane automatism the defence has to persuade the jury that the defendant was more likely than not legally insane. In non-insane automatism the prosecution has to persuade the jury that they are sure that the defendant wasn't in a state of loss of voluntary control.

It is very difficult for juries to understand these two entirely different tests. It is also difficult for judges, and this is reflected in the incorrect direction given to the jury in *Lowe* [81,82], where he stated that for insane automatism the legal test was total loss of voluntary control, rather than the *MacNaughtan Rules*.

This is a very confusing area of the law, which requires reform. However, there are circumstances where behaviour during or arising out of sleep will not be excused. For example, if the defendant knows that alcohol triggers his sleepwalking, this may be deemed as self-induced and so not a legal excuse. This was the basis of the decision in *Finegan v Heywood* [83], where the High Court clearly agreed that Finegan had been in a parasomniac state when he drove a car whilst unfit through drink. Nonetheless, his conviction was upheld because he was at fault for drinking, when he knew that drinking would trigger his sleepwalking. The Sheriff stated that:

*"For the accused to be acquitted on the defence of non-insane automatism, which was that advanced on his behalf, the court, following Ross v HM Advocate 1991 JC 210 would have to be satisfied on a number of factors. These are that Mr Finegan acted with a total alienation of reason, that this alienation was caused by an external factor, that his state was not self-induced and that he was not bound to foresee that factor."*

*Despite what was argued on his behalf, although I have accepted that he was sleepwalking when he took the vehicle, I am not satisfied that these four essential criteria are met. In particular I do not accept that the accused's state was not 'self-induced'. He had drunk the alcohol. He knew, even by his own 'fifty-fifty' assessment which seemed to me to have been tailored for the occasion, that parasomniac states had been preceded by ingestion of alcohol."*

Lord Justice-General Rodger in the High Court stated

*"that the defence of automatism could not be established on proof that the accused was in a transitory state of parasomnia which was*

*the result of, and induced by, deliberate and self induced intoxication"*.

The issue of prior fault is a frequent bar to the defence of automatism, and often prevents diabetic drivers who suffer hypoglycaemia from succeeding with the automatism defence. The same might be held where someone with known sexsomnia who puts himself in a risky situation, that he or she had caused the conditions for their own defence.

### Insanity

Expert evidence where a mental condition defence is raised, such as in violent sleep cases, needs to address two questions: culpability and future dangerousness. The statutory special verdict of not guilty by reason of insanity arose out of a need for social control of potentially dangerous individuals. Insanity is a legally defined concept, a term of art, rather than a medical diagnosis or classification. It does not require any existing psychiatric illness or permanent impairment. Additionally, the presence of a mental illness itself does not necessarily lead to a plea of insanity if the person is considered legally responsible for their behaviour at the time of the guilty act. This plea is usually submitted following extensive psychological and psychiatric reports of the accused, determining whether their concepts of "right and wrong" were impaired at the time of the act. It is considered to be the result of an organic dysfunction of the brain and so includes epilepsy, diabetes and arteriosclerosis, if these result in criminal behaviour. This causes confusion for medical experts who are not psychiatrists, who believe that because sleep disorders are not primarily psychiatric disorders that the law does not classify them as insanity.

Classifying all automatic behaviour as insanity has been described as: "such a bad decision that it beggars description and defies analysis" [84]. When automatism results from an external factor, which is unforeseen and unlikely to recur (for example a concussive blow, or poisoning), the defence of "non-insane" automatism can be raised. The distinction between internal and external events is an attempt by the courts to address the policy issues of individuals who are potentially dangerous not being subject to social control if there is a plain acquittal. There are two main difficulties with this. The first is where something that is judged to be an external factor is actually a circumstance that is likely to recur – the best example of this is the administration of insulin to a diabetic. The second is deciding whether or not the condition has an internal or an external cause, given that most medical conditions consist of one or more predispositions and precipitants. Sleepwalking precipitated by obstructive sleep apnoea will be generally very responsive to continuous positive airway pressure (CPAP) treatment, but would be treated by the courts as an internal cause and therefore insanity.

Michael Coles has provided a very useful classification of types of automatism (Table 2):

Not all of the five types and nine subtypes of behaviour would constitute legal automatism; however, it's a useful reminder that not all causes of legal automatism are the same. Type 1 and 2 behaviours are unlikely to cause much difficulty for the courts and are clearly legal automatisms. Type 3 behaviour is not considered legal automatism (but might come under the partial defence of provocation). Types 4 and 5 are the most likely to involve complex behaviour AND be caused by conditions that would be recognized as automatism or insanity. Type 4a behaviour could come from a sudden awakening from sleep, or 'confusional arousal'. Type 4b is classical sleepwalking behaviour. Type 5 behaviours are generally due to substances or mental illness, except for 5b which could be due to a night terror or REM sleep behaviour disorder.

**Table 2**  
From ‘Scientific support for the legal Concept of automatism’ with kind permission of Michael Coles [103].

Automatic behaviour. Behaviour where the conscious mind does not go with what is being done
1) Absence of volition without conscious awareness – for example, autonomic and central nervous system activity which would include:  a) physiological processes b) neurological reflexes
2) Absence of volition with clear conscious awareness  a) neurological reflexes
3) Volitional behaviour with constricted conscious awareness  a) irrational behaviour while highly emotional
4) Volitional behaviour with diminished conscious awareness  a) inadequate responses to partially perceived stimuli b) habits and well learned skills
5) Volitional behaviour with distorted conscious awareness  a) responses to confused perception of reality b) responses to the content of dreams c) responses to hallucinations

Classification of sleep disorders in criminal law

However, the issue of how non-REM sleep disorders, and in particular sleepwalking, are classified (insane vs. non-insane automatism) is more complicated. The court in *R v Burgess* [85], whilst recognizing that sleep is a normal condition, held that sleep walking and particularly violence in sleep were not. Because sleep walking has an internal cause, following the decisions in *Quick* [86] and *Sullivan*, [87] it has to be considered a ‘disease of the mind’ and an insane automatism as a consequence. In the former case, it was decided that hypoglycaemia in a person with type I diabetes was an internal cause while in the latter case epilepsy was also determined to be an internal cause. Table 3 lists internal and external causes.

**Table 3**  
Internal vs. external factors. Whether or not these factors are judged to be external or internal is often for the jury to decide, although the judge may specifically instruct the jury that special verdict is not available because only internal factors operating as per *Burgess* [104].

Internal	External
Sleepwalking	Confusional arousal due to external stimuli (general lack of a predisposition and requirement for an external trigger, usually considered an external factor by the courts)
Sexsomnia	Abnormal stress
Sleep terrors	Sleep deprivation
REM sleep behaviour disorder	Confrontation
Nocturnal epilepsy/epileptic nocturnal wandering	Alcohol (see discussion earlier)
Confusional arousal resulting from internal stimuli e.g., sleep-disordered breathing	Drug treatment or withdrawal including insulin administration
Other parasomnia triggered by sleep-disordered breathing	Excessive caffeine or other stimulant consumption [105] External stimuli e.g., loud noise; commotion outside sleep area causing abrupt arousal

REM, rapid eye movement.

By contrast, in the Canadian case of *Parks* in 1992 [88] it was held that sleepwalking is not a disease of the mind because it arises out of sleep and sleep is a normal condition. Thus Parks’ plain acquittal was upheld. However in the case of *Luedecke* [89] (a case of sex-somnia), the Ontario Court of Appeal held that the important determinant was ‘continuing danger’ and therefore the question of automatism or the special verdict would be decided on a case-by-case basis. Luedecke was acquitted at a limited retrial (concerned only with whether or not a plain acquittal or special verdict was appropriate) on the grounds of being not criminally responsible on account of mental disorder. This meant he could be (and was) subject to compulsory monitoring and treatment.

The importance of this distinction depends on the jurisdiction. In the USA, there is less flexibility of disposal for those who argue the insanity defence compared to the UK. In England & Wales, the judge is free to impose an outpatient supervision order or even an absolute discharge rather than the detention at Her Majesty’s pleasure (theoretically up to life, but in the case of Lowe he was detained for just ten months [90]) which was compulsory before the Criminal Procedure (Insanity and Fitness to Plead) Act 1991. Luedecke received an absolute discharge. For these reasons, we believe that there is not the same need for sleepwalking to be treated as an insane automatism in the UK.

Some sleep physicians are not aware of this flexibility. In a series of interviews of sleep physicians, several considered that the verdict of not guilty by reason of insanity was not appropriate, but that compulsory treatment and follow up was appropriate. When they were informed of the likelihood of an outpatient supervision order, roughly equal numbers were for and against sleepwalking being treated as an insane automatism. Sleep specialists trained in respiratory medicine were more likely to consider parasomnia a non-insane automatism than those trained in psychiatry or psychology [91].

Despite the legal precedent of *Burgess*, only one defendant raising the sleepwalking defence has been found not guilty by reason of insanity from 1996 to 2012 in the UK (Jules Lowe). It is not known whether this is primarily due to the judges’ instructions to the jury, or juries making their own decisions about what constitutes insanity. The judge in the recent trial of Zack Thompson for rape, where the sleepwalking defence was raised, held that Thompson would only be allowed to argue for an insane automatism. Certainly as the case of Brian Thomas shows (see below), not all judges direct that the only form of acquittal open to the jury is the special verdict of not guilty by reason of insanity.

The case of Brian Thomas may illustrate the triumph of pragmatism over legal precedent. In 2009, Brian Thomas strangled his wife in their campervan. Brian Thomas had a long history of sleep disorders since childhood including sleepwalking, restless legs and bruxism but had not seen a sleep specialist prior to the incident. He was on medication for other disorders, and he believed this medication caused erectile dysfunction. Periodically he would come off it to resume sexual relations with his wife.

He and his wife went on holiday for a weekend and parked overnight in Aberporth, Wales UK, with the accused having stopped his medication the preceding week. Young drivers in the car park had disturbed them from sleep earlier in the night. He had consumed some alcohol but not to excess. His diagnosis of Parkinson’s disease (which was questionable) did suggest REM sleep behaviour disorder as a possibility. He slept in the same narrow bed as his wife, whereas at home they slept in separate beds. Later that night he had a dream that an intruder had entered the campervan and was on top of his wife. He tried to get the intruder off. When he awoke his wife was dead and he realized that he must have strangled her during this dream. He phoned the police straight away and stated that he believed he had killed his wife.



Both sleep experts in this case agreed that this was a *bona fide* example of the parasomnia defence – the sleep studies were supportive of confusional arousal (related to obstructive sleep apnoea found on the sleep study) or sleep terror. Mrs Thomas also had a history of sleepwalking, and so her own sleep behaviour could have precipitated a confusional arousal on the part of Mr Thomas. The defendant had no discernible motive to kill, being devoted to his wife. There was no attempt in this case by the prosecution to prove prior fault on the basis that Mr Thomas had come off his medication.

The trial went ahead at Swansea Crown Court with the only issue being whether Mr Thomas would be found not guilty, or not guilty by reason of insanity. After hearing the expert evidence that suggested that Mr Thomas posed no danger to the public and would not benefit from detention in a special hospital, the judge directed the jury to acquit. This was despite both sleep experts agreeing that Mr Thomas needed ongoing psychiatric supervision, for his own wellbeing more than public safety.

### *The special case of sleepwalking*

Sleepwalking is seen as a classic example of a legal automatism. Lord Denning in *Bratty v. Attorney General for Northern Ireland* stated that automatism is “an act which is done by the muscles without any control by the mind such as a spasm, a reflex action or a convulsion; or an act done by a person who is not conscious of what he is doing such as an act done whilst suffering from concussion or whilst sleepwalking” [92]. The Draft Criminal Code drawn up by the Law Commission states at clause 33(1) that a person will not be convicted:

if he acts in a state of automatism, that is, his act:-

- i) is a reflex, spasm or convulsion; or
- ii) occurs while he is in a condition (whether of sleep, unconsciousness, impaired consciousness or otherwise) depriving him of effective control of the act [93].

Thus, given the status of acts that arise out of sleep, it is inevitable that where the defendant's acts *could* have arisen out of sleep, the defence will try and establish that they did. This might have the consequence of causing “diagnostic creep” on the part of forensic sleep experts and is one argument for scrapping the external factor doctrine. This states that external factors can be a cause of non-insane automatism, but internal causes must be treated as insane automatism. Another argument for treating sleep disorders as insanity is that then the burden of proof would be on the defence to prove a sleep disorder on the balance of probabilities. This would disadvantage the sleepwalking defendant, but would help to ensure that the defence could not succeed by merely raising the reasonable doubt that someone was awake.

There has been an increasing media interest in the sleepwalking defence. When Zack Thompson was sentenced at Nottingham Crown Court in 2012 for rape, Detective Constable Paula Winfield commented that

*“Sleepwalking as a criminal defence had never been successfully challenged in a sexual offence before. But we could not let that discourage us from doing all we could to achieve justice for a young woman who has been through such a traumatising ordeal” [94] adding “We hope this conviction sends out the message that sleepwalking can no longer be a safe defence in cases of rape.” [95]*

It was certainly not a “first”, and, of course, the traumatic nature of the woman's ordeal is no indicator that the defendant was not sleepwalking. The underlying assumption in the police officer's remark is that a dangerous new legal defence has now been successfully challenged in its entirety.

In 2008, Harry Cohen, then Member of Parliament for Leyton and Wanstead, submitted an early day motion in parliament proposing a change in the law which would have denied the defence of automatism to those accused of sexual offences [96]. He commented: “A rape is a rape and should be treated as such”, a truism that apparently ignores the fundamental tenet of criminal law that only voluntary actions are punished.

### *Issues of expert evidence*

The issue of admissibility of expert evidence has recently been examined by the Law Commission in the UK [97]. They were concerned about the contribution of flawed expert evidence to miscarriages of justice. The Law Commission quoted several organisations' concerns about the provision of expert evidence and the need for reform in its report ‘Expert Evidence in Criminal Proceedings in England and Wales’ [98].

The General Medical Council stated (para 1.16):

*“it is because juries and other lay tribunals tend to afford a special status to [scientific medical] evidence that a robust assessment of its admissibility prior to trial is critical”*

The Criminal Bar Association noted that (para 1.16):

*“rightly or wrongly, [expert evidence] is often ‘trusted’ like no other category of evidence”*

Given the impact of unreliable expert evidence, the Law Commission have proposed the adoption of a statutory test for expert evidence which would be an enhanced admissibility on the lines of Rule 702 in the Federal Rules of Evidence. This states that:

*A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if:*

- a) *the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue;*
- b) *the testimony is based on sufficient facts or data;*
- c) *the testimony is the product of reliable principles and methods; and*
- d) *the expert has reliably applied the principles and methods to the facts of the case.*

These tests have been considered by judges before – the Court of Appeal in *Luttrell* [99] didn't consider it necessary for expert evidence that “the methods used are sufficiently explained to be tested in cross-examination and so to be verifiable or falsifiable”. Not everyone would agree that the fundamental problem is the expert witnesses involved. Some would say that it's the lawyers' fault [100] – that the advocates are not testing the evidence sufficiently rigorously. Judge Andrew Gilbert Queen's Counsel, Honorary Recorder of Manchester, commented on “*how ill equipped advocates are to challenge [poor quality scientific evidence] when they have no experts of their own to advise them*” [101]. Criminal cases involving a putative sleep disorder are uncommon, so the individual lawyer is highly unlikely to have come across a case before. Some lawyers carry out extensive research to enable the rigorous cross-examination of expert witness, but it is not consistently the case.

Medical experts in the UK *must* bear in mind that their first duty is to the court, as per Part 33.2 of the Criminal Procedure Rules. This duty is aligned with their duty to society and to medical science. The same is not necessarily true for their duty to the instructing barrister or the defendant (the majority decision in *Jones v Kaney* notwithstanding [102]). One sleep expert commented that the area of forensic sleep disorders is “a barrister's playground” [91] – sleep experts must ensure that they are not lawyers' playthings. It is

problematic trying to apply the rules of evidence-based medicine to expert testimony for two reasons. The first is that forensic sleep disorders still rely on experienced experts who have the accounts of their patients to guide them as regards possible behaviour during parasomnias. The second is that it is indubitably for the courts to decide which evidence is eligible. Where an individual's reputation and liberty are at stake, it may well be appropriate to hear an expert's opinion on whether or not certain behaviour is consistent with parasomnia. The legal system is well acquainted with the difficulties of determining fact.

## Conclusions

Sleep physicians are increasingly being called upon to consider sleep as a possible contributory factor in criminal proceedings. This is a particularly complex area, with little evidence to support opinion in court. Investigations are of little value and expert evidence is largely opinion-based on history from patients, family and friends, and eye witnesses of the illegal act in question.

There has been very little research to establish causative factors for sleep-related violence. Psychiatric co-morbidities or confounders are often not considered.

Guidelines for assessing someone suspected of committing a crime in the context of a parasomnia or during sleep are non-existent in many countries, making this a minefield for both prosecutor and defence (guidelines have been suggested [78,82]). There are very limited reports from the non-English speaking countries and limited literature from the non-USA, non-UK jurisdictions (i.e., countries with legal systems not based in common law). We therefore suggest that all patients with a significant parasomnia, which could potentially result in violence or forensic behaviour, be referred and fully investigated in sleep centres with the appropriate facilities and expertise in the assessment of these disorders.

This will require public education, as patients often do not present to their general practitioners early enough. There is an urgent need for guidelines to ensure that assessment is based on sound evidence and full psychiatric assessment, supported by a strong evidence base on prevalence and pathogenesis of criminal behaviours in sleep that, as shown above, is currently lacking.

When faced with a violent or illegal act said to arise from or occur during sleep, physicians should first establish whether the behaviour was due to an arousal disorder, REM-behaviour disorder, nocturnal dissociative episode, malingering or a functional disorder (including Munchhausen's). The second step is to determine whether the behaviour was the result of external or internal factors (pre-existing medical, psychological or psychiatric illness). It is then for the courts to answer the legal question of whether the disorder amounts to insanity or non-insane automatism. Reform of this complicated area of the law is well overdue, and the UK forensic sleep science community should engage with the Criminal Law Commission consultation so that any legislation is fit for the purposes of protecting both society and the individual sufferer.

## Practice points

- 1) There is very little knowledge in the medical literature concerning the association of psychopathology with disorders of arousal in which violence/illegal activity occurs. Most of the knowledge is based on observational studies from the American and British literature, with no longitudinal or case-control data available. There are few publications regarding jurisdictions not based in common law or cases from non-English speaking countries.

- 2) Disorders of arousal associated with violence or exhibiting marked executive function and excellent recall should always be investigated and treated in greater depth. Full neuropsychological or psychiatric assessment may be necessary, especially if there is a medico-legal issue at stake.
- 3) The clinician should be alert to the possibility of psychological and psychiatric illness presenting as a disorder of arousal. This can occur in the context of a genuine disorder of arousal.
- 4) Whether an automatism is considered insane or sane is not for the clinician to decide – it is a legal question which the jury decides.

## Research agenda

- 1) Longitudinal studies of personality changes and dissociation in patients with disorders of arousal.
- 2) Imaging studies of patients with disorders of arousal, including correlation with electro-encephalographic rhythms.
- 3) Better definition of more objective tests for patients presenting with disorders of arousal.
- 4) We call for large multi-centre trials to be undertaken with longitudinal follow-up of patients presenting to tertiary sleep centres with arousal disorders and looking at potentially criminal behaviour, whether or not it has been brought to the attention of authorities. Control groups should be chosen carefully from amongst the 'normal population' as well as those presenting with "milder" forms of disorders of arousal. Ideally subjects would be studied with the benefit of contemporary documentation in sleep diaries AND the use of proprietary unattended sleep monitors and infra-red cameras
- 5) Knowledge of and approaches to disorders of arousal in non-common law jurisdictions need to be published.

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## Appendix A

John Rumbold conducted a qualitative study of forensic sleep experts, with names gathered from the academic literature or by a snowball sampling technique. The project was focused on the framing of expert evidence about parasomnias in criminal trials. A semi-structured interview was conducted for between 20 min and an hour with 23 subjects (mostly UK experts, but some North American experts and some other stakeholders also). The data were analysed using grounded theory. This research will be full reported in John Rumbold's thesis.

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